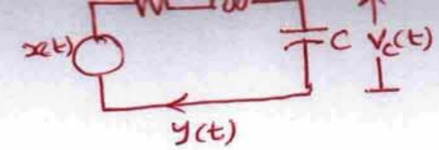
(2) Applying KVL



$$x(t) - R\,y(t) - L\frac{dy(t)}{dt} - V_c(t) = 0$$

$V_c(t)$ = Voltage across the capacitor

$$y(t) = C\frac{dV_c(t)}{dt}$$

$$\therefore V_c(t) = \frac{1}{C}\int_{-\infty}^{t} y(t)\,dt$$

$$\therefore x(t) - R\,y(t) - L\frac{dy(t)}{dt} - \frac{1}{C}\int_{-\infty}^{t} y(t)\,dt = 0$$

Differentiating w.r.t. t.

$$\frac{dx(t)}{dt} - R\frac{dy(t)}{dt} - L\frac{d^2y(t)}{dt^2} - \frac{1}{C}y(t) = 0$$

or

$$L\frac{d^2y(t)}{dt^2} + R\frac{dy(t)}{dt} + \frac{1}{C}y(t) = \frac{dx(t)}{dt}$$

Now $R = 2\,\Omega$ $L = C = 1$

$$\therefore \frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = \frac{dx(t)}{dt}$$

Homogeneous solution is

$$\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = 0 \qquad N=2$$

its solution is

$$y^h(t) = \sum_{i=1}^{N} C_i e^{\gamma_i t} = C_1 e^{\gamma_1 t} + C_2 e^{\gamma_2 t}$$

its characteristic equation is

$$\sum_{k=0}^{N=2} a_k \gamma^k = 0$$

$$a_0\gamma^0 + a_1\gamma^1 + a_2\gamma^2 = 0$$

$$1 + 2\gamma + \gamma^2 = 0$$

$$\therefore (\gamma+1)^2 = 0$$

$$\therefore \gamma = -1, 1 \text{ (equal roots)}$$

$$\therefore y^h(t) = C_1 e^{-t} + C_2 t e^{-t}$$